This problem corresponds to PEENPP chapter 7, problem number 12.

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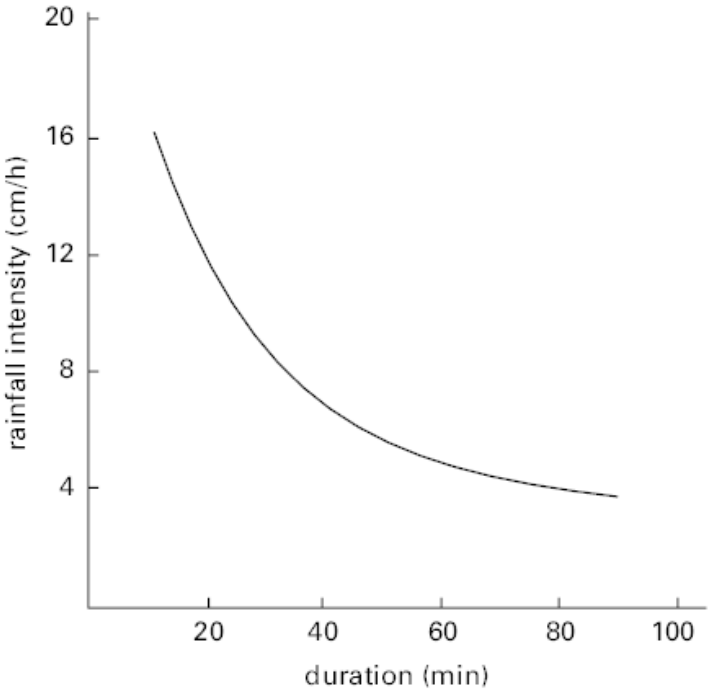
Test Bank Question preview

Question

A watershed occupies a 30 ha site. 18 ha of the site have been cleared and are used for pasture land; 1 ha is occupied by farm buildings, a house, and paved surfaces; the remaining 11 ha are woodland. The average land slope is 2.1%. Because the site is upland from a residential development, the rainfall runoff from the site is collected in a catchment that discharges directly to a culvert. The overland flow distance to the catchment is 212 m. The 20 yr storm is characterized by the intensity duration curve presented in the figure.



For a 15 min storm duration and average runoff coefficient of 0.18, the time of overland flow for the watershed is most nearly

Answers

(A) ~~5.6~~ min

(B) ~~18~~ min

(C) ~~26~~ min

(D) ~~47~~ min

The answer is (B).

Solution

Content in blue refers to the NCEES Handbook.

From the figure, for a storm duration of 15 min, rainfall intensity, *i*, is 14 cm/hr.

QUESTION DATA

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Solving Time

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OTHER VERSIONS

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$$i = \frac{14 \ \frac{\text{cm}}{\text{hr}}}{2.54 \ \frac{\text{cm}}{\text{in}}} = 5.51 \ \text{in/hr}$$

Find the time of overland flow.

$$\begin{aligned}
t_i &= \text{time of overland flow, min} \\
C &= \text{runoff coefficient} = 0.18 \\
L &= \text{overland flow distance} \\
&= (212 \ \text{m}) \left(3.28 \ \tfrac{\text{ft}}{\text{m}}\right) = 696 \ \text{ft} \\
S &= \text{slope} = 2.1\%
\end{aligned}$$

Time of Concentration

$$\begin{aligned}
t_i &= C\left(L / S \, i^2\right)^{1/3} \\
&= (0.18) \left(\left(\frac{696 \ \text{ft}}{0.021 \ \frac{\text{ft}}{\text{ft}}} \right) (5.51 \ \tfrac{\text{in}}{\text{hr}})^2 \right)^{1/3} \\
&= 18 \ \text{min}
\end{aligned}$$

This problem corresponds to PEENPP chapter 2, problem number 5.

Test Bank

Question preview

Question

A sharp-edged flow-restricting orifice with a 2 cm opening is placed inside a 5 cm pipe. The orifice coefficient is most nearly

Answers

(A) 0.58

(B) 0.61

(C) 0.63

(D) 0.65

The answer is (C).

Solution

Content in blue refers to the NCEES Handbook.

Find the coefficients of velocity and contraction for a sharp-edged orifice. [Orifices]

$$C_{\text{v}} = \text{coefficient of velocity} = 0.98$$
$$C_c = \text{coefficient of contraction} = 0.62$$

Calculate the orifice coefficient.

$$C = \text{orifice coefficient}$$
$$A_0 = \text{orifice opening cross-sectional area or orifice diameter} = 2 \text{ cm}$$
$$A_1 = \text{pipe cross-sectional area or pipe diameter} = 5 \text{ cm}$$

$$C = \frac{C_{\text{v}} C_c}{\sqrt{1 - C_c^2 (A_0/A_1)^2}}$$
$$= \frac{(0.98)(0.62)}{\sqrt{1 - (0.62)^2 \left(\frac{2 \text{ cm}}{5 \text{ cm}}\right)^2}}$$
$$= 0.63$$

QUESTION DATA

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